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How scientists come to say what they say about climate change

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The Intergovernmental Panel on Climate Change (IPCC) and scientific consensus: How scientists come to say what they say about climate change[§]

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Abstract

This paper first gives a briefing on the background, organisation and functioning of the Intergovernmental Panel on Climate Change (IPCC). We then give some background on climate change in the past before considering what IPCC says about likely future impact of anthropogenic emissions of greenhouse gases.

1 Introduction

In its Second Assessment Report (SAR) from 1995 the IPCC concluded that

> «The balance of evidence, from changes in global mean surface air temperature and from changes in geographical, seasonal and vertical patterns of atmospheric temperature, suggests a discernible human influence on global climate. There are uncertainties in key factors, including the magnitude and patterns of long-term natural variability.»

Although carefully worded the statement has created a rather heated debate, also among climate scientist. Some well-known and respected scientists disagree that we at this moment in time are able to discern a human influence on the global climate. Also in connection with the production of the last Assessment report, some procedural errors were introduced in the final editing of the chapters of the report. These errors were then used by interest groups opposed to climate change policy to discredit the whole report and the organisation producing the report - IPCC.

On this background it is understandable that some have come to see IPCC and its reports as mainly *political manifestations*, to be discussed within the political arena on par with other political topics such as the 'right' fiscal policy, etc. Thus, a basic misconception of IPCC as a political body has been spreading.

In this presentation we will first of all try to convey what IPCC is and what it is not. Then we will come back to a discussion of the above statement on the likely human impact on climate change and briefly relate it to natural climate change in the past. In closing, we will finally say a few words on the nature of the problem of climate change.

2 IPCC: The background, organisation and procedures

2.1 Background: The history of the climate problem

Scientific recognition of the potential of human activity to modify climate dates back at least to the early nineteenth century. Thus, in 1827, Baron Jean-Baptiste Fourier suggested that human activity can modify surface climate, and he was perhaps one of the first to suggest the now well known greenhouse effect of the atmosphere (Fourier, 1827, Ramanathan, 1988).

The greenhouse theory of climate change was, however, only taken up in earnest later in the last century when in 1896 the Swedish scientist Svante Arrhenius published his first estimate of a man-made global temperature change caused by man-made emissions (Arrhenius, 1896, Rodhe et. al., 1997). His main insight was that burning of fossil fuels and the release of CO_2 could affect the escape of heat from the Earth.

The next milestone can perhaps be said to relate to research carried out by Roger Revelle and Hans Suess at the Scripps Institute of Oceanography in the 1950s. Their research indicated that the oceans only seem to absorb about half of the manmade CO_2 emissions.

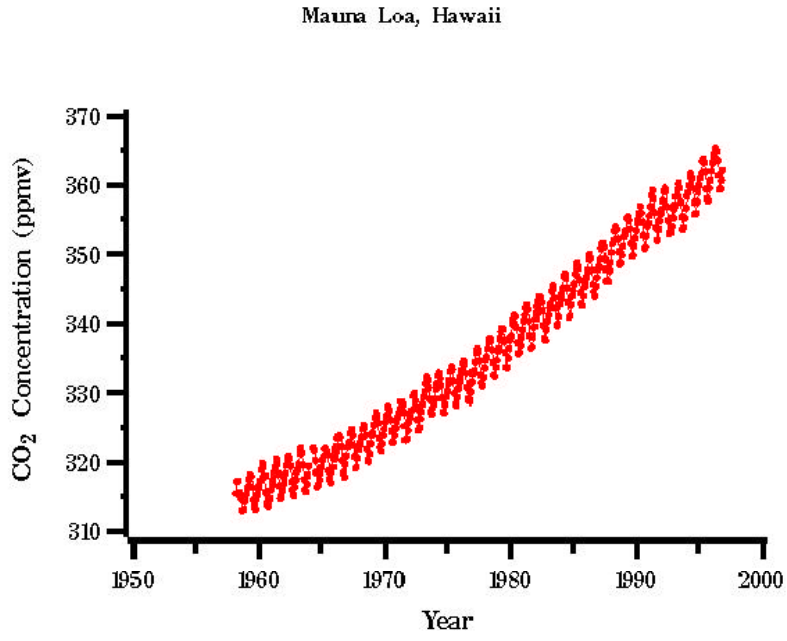

Figure 1: Measurement of CO_2 concentration at Mouna Loa, Hawaii

This research led in turn to the establishment of a monitoring network under the guidance of Charles Keeling from the same institute. This monitoring firmly established that the CO_2 concentration in our atmosphere is increasing and is now far above the level believed to have existed in pre-industrial times (280 ppmv), see figure 1.

Scientific interest in man's potential impact on global climate was stirred by the research and monitoring initiated in the 1950's, and this interest was further mobilised through conferences, loose research networks and assessments especially from the 1970's onwards (Agrawala, 1998).

The starting point for the recent international efforts to better understand climate variations and the possible problem of a human-induced climate change is generally regarded to be the UN Conference on Human Development in Stockholm in 1972. At this conference results from a numerical climate model predicting climate development into the next century were presented. Further refinement of this type of model, together with a report from the University of East Anglia highlighting that the 1980s contained several of the warmest years in the historical record (see figure 2), created widespread concern about climate change as a man-made global environmental problem.

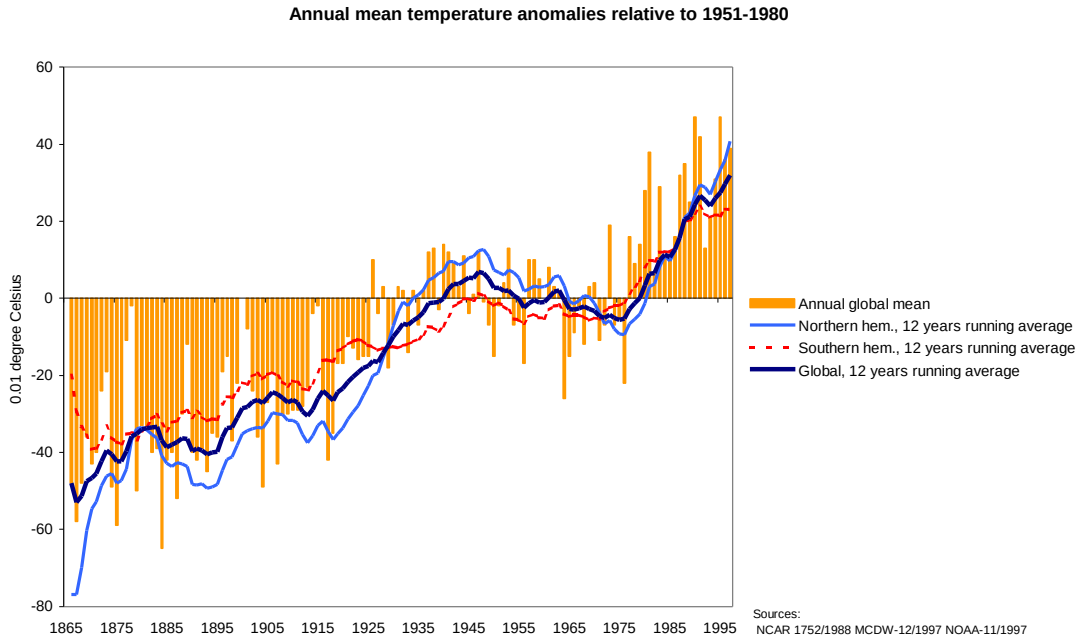

Figure 2: Annual mean temperature anomalies relative to 1951-1980

In 1979 the World Climate Conference was held in Geneva, and the World Climate Programme (WCP) was launched. The creation of the WCP set forth a series of workshops held in Villach, Austria, in 1980, 1983 and 1985 and organised under the auspices of the World Meteorological Organization (WMO), the United Nations Environment Programme (UNEP) and the International Council of Scientific Unions (ICSU) (Agrawala, 1998). At the 1985 Villach meeting an international group of scientists reached a consensus that, as a result of the increasing concentrations of greenhouse gases in the atmosphere, a rise in the global mean temperature "greater than any in man's history" could occur in the first half of the next century. This group of experts also stated that "…the understanding of the greenhouse question is sufficiently developed that scientists and policy-makers should begin active collaboration to explore the effectiveness of alternative policies and adjustments" (WMO, 1985).

In combination with a set of other factors, especially anomalous weather conditions in Europe and America, the 1985 Villach meeting was instrumental in bringing the climate issue onto the international political agenda. In 1986 the Advisory Group on Greenhouse Gases (AGGG) was set up under the joint sponsorship of WMO, UNEP and ICSU. Each of these bodies nominated two experts, and the panel consisted of six members: Gordon Goodman, Bert Bolin, Ken Hare, G. Golitsyn, Sukiyoro Manabe and M. Kassas (Agrawala, 1998).

During the latter half of the 1980's the climate issue increasingly gained saliency among the public, scientists and policy-makers, not least through the work of the so-called Brundtland Commission (WCED, 1987). At the Toronto Conference of the Atmosphere, where more than 300 scientists and policy-makers from 48 countries, UN organisations, IGOs and NGOs participated, an explicit policy recommendation calling upon national governments to reduce CO_2 emissions by 20% from 1988 levels by 2005 was agreed upon.

Meanwhile, the WMO and UNEP in close co-operation with various US agencies agreed that an intergovernmental mechanism was needed to undertake further internationally co-ordinated scientific assessments of climate change, and invitations to governments to the first session of the Intergovernmental Panel on Climate Change (IPCC) were sent out early 1988. The first plenary session of the IPCC took place in November 1988. The AGGG set up in 1986 was gradually replaced by the IPCC and has not met since 1990.

2.2 The function and products of the IPCC

The main purpose of the IPCC is to provide assessment reports of state-of-the-art knowledge on climate change. The objective of the IPCC, as formulated by the governing bodies of WMO and UNEP, is twofold:

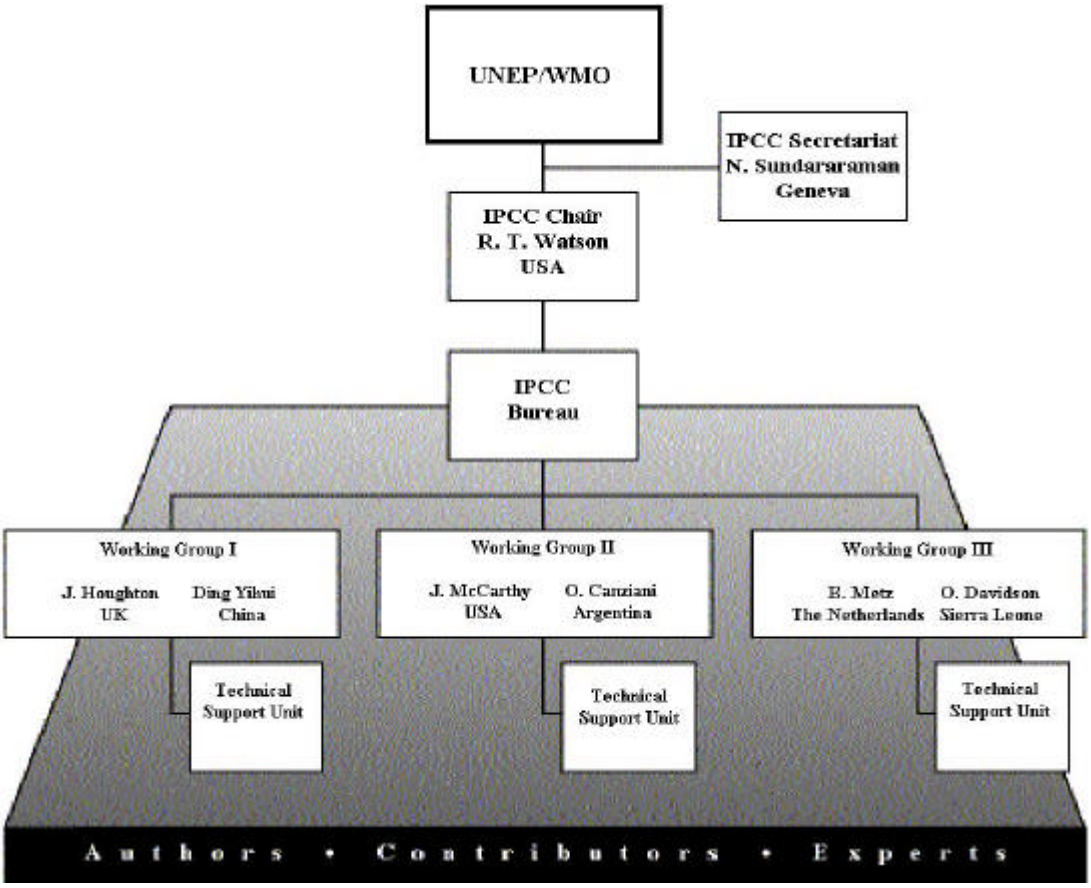

Figure 3: IPCC organisation

IPCC reports

- *Assessment Reports*: The full scientific assessment with status as "Reports accepted by WGs". Accepted by WG plenary, but not subject to discussion.
- *Executive summaries and Summaries for Policy-makers*: Summaries of the full scientific assessment with status as "Reports approved by WGs and accepted by the Panel". Subject to line-by-line approval by WG plenary. Accepted by full panel plenary, and not subject to discussion at this decision-making level.
- *Synthesis Reports*: Synthesis of the reports of all WGs, developed by the WG leadership in co-operation with lead authors and specially invited experts with status as "Reports approved by the Panel". Subject to line-by-line approval by full panel plenary.
- *Special Reports*: Assessments on special issues. Subject to the review, acceptance and approval procedures of the assessment reports in general.
- *Technical Papers (since 1995*): Reports on specific issues, based on existing assessment reports, not submitted to the acceptance and approval procedures of the assessment reports.

i) To assess the scientific information related to the various components of the climate change issue and the information needed to evaluate the environmental and socio-economic consequences of climate change, and
ii) To formulate "realistic response strategies for the management of the climate change issue" (Report of the first session of the IPCC).

In 1988, three Working Groups (WGs) were set up to attain this objective:

- *Working Group I (WGI)* was assigned the task of assessing available scientific information on climate change,

- *Working Group II (WGII)* was assigned the task of assessing environmental and socio-economic impacts of climate change, and

- *Working Group III (WGIII)* was assigned the task of formulating response strategies.

In 1992, the IPCC structure was slightly changed: Working Groups II and III were merged in the old Working Group II, while a new Working Group III was set up to deal with socio-economic and other cross-cutting issues related to climate change.

IPCC has as one of its main tasks to assess "scientific information". All working groups conduct assessments on the basis of published literature within relevant fields and disciplines. Thus, IPCC does not carry out scientific research. Furthermore, the term "scientific information" is generally taken to mean that only published and peer reviewed scientific material is taken into account.

In connection with the planned Third Assessment Report (TAR), a slight readjustment of the mandate for the three working groups has been suggested as follows:

- Working Group I will assess the *scientific aspects* of the climate system and climate change (as before);

- Working Group II will assess the scientific, technical, environmental, economic and social aspects of the *vulnerability* (sensitivity and adaptability) to climate change of, and the negative and positive consequences (impacts) for, ecological systems, socio-economic sectors and human health, with an emphasis on regional sectoral and cross-sectoral issues;

- Working Group III will assess the scientific, technical, environmental, economic and social aspects of the *mitigation* of climate change, and through a task group (multi-disciplinary team), will assess the methodological aspects of cross-cutting issues (e.g., equity, discount rates and decision making frameworks).

While the main products of IPCC are the assessment reports, other types of reports are also produced (see text box). The First IPCC Assessment Report was presented to the Second World Climate Conference in 1990, where it was accepted as an adequate basis upon which to start climate negotiations. In December 1995, the IPCC Plenary accepted the Second IPCC Assessment Report. Work on a Third Assessment Report (TAR) is underway (current work plans suggest finalisation in 2001).

2.3 The Assessment Process

The IPCC is organised in three decision-making levels that serve different functions in the assessment process: the "scientific core", the WG plenaries, and the full panel (IPCC) plenary at the top of the institution, see figure 4.

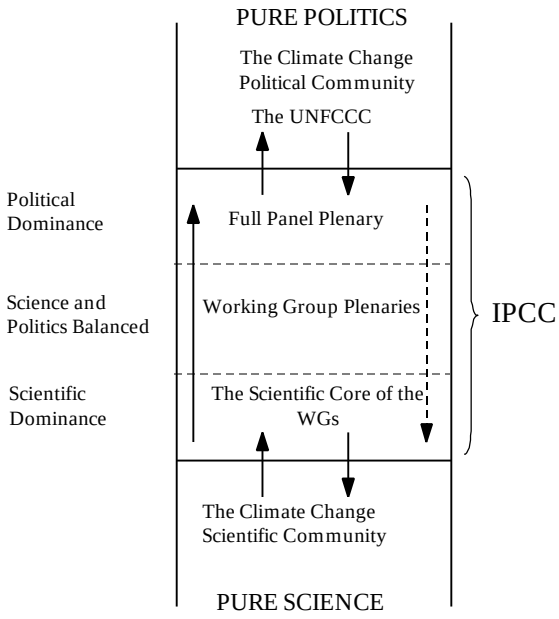

Figure 4: The different levels of the IPCC process

At WG and panel plenaries, all UN members and members of the IPCC's two sponsoring organisations, the WMO and UNEP, can participate. Participation at these levels is in principle open. Governmental authorities nominate all members of national delegations.

At the start of an assessment process, the leaders of each WG develops a work-plan for the assessment, which is subsequently approved by the plenary of the WG and accepted by the full panel plenary. Governments nominate teams of lead- and contributing authors. The bureau (chair and vice-chairs) of each WG selects lead authors from the nomination lists provided by governments. Contributing

authors may also be specially invited; however, with due consideration of the geographic balance of the groups, particularly with regard to ensuring participation by scientists from developing countries. Lead authors participate in their personal capacities.

The assessment reports are developed in the scientific core of the IPCC, in a series of meetings in task forces and sub-groups established for particular issues, workshops and conferences, and most importantly, in regular lead- and contributing author meetings. The summaries to the assessments – the summary for policy-makers and the executive summary – are also developed at this level. Scientists active in research dominate participation in the scientific core.

When a draft report has been developed, it is submitted to an extensive, two-phased review procedure, including both expert and government review. According to the rules of procedure of the IPCC, lead authors, WG chairs, sub-group chairs and vice-chairs are responsible for incorporating comments from the review "as appropriate". In this regard, lead authors, chairs and vice-chairs are encouraged to arrange wider meetings with principal contributors and reviewers to discuss particular aspects or areas of major differences, as deemed necessary and if time and funding permits. It is also emphasised in the rules of procedure that the assessment reports "describe different (possibly controversial) scientific or technical views on a subject, particularly if they are relevant to the political debate".

The revised draft of the assessment and its summaries are then submitted to the WG plenary for acceptance and approval. At this level, the discussion takes on quite a different character. While the full scientific assessment report is accepted by the plenary en bloc and usually without further discussion, the summaries – the Executive Summary (ES) and the Summary for Policy-makers (SPM) – undergo a detailed and time consuming revision where the formulations of the documents are discussed and negotiated line-by-line.

The main bulk of participants to WG plenaries are national delegations, comprising government officials, low-level policy-makers and/or scientists with governmental affiliations. National governments to a varying extent send independent scientists as members of national delegations to WG plenary meetings.

Mainly representatives of the teams of lead authors represent scientists at this decision-making level. Lead authors have acquired a special status as authorities in the debate, and substantive changes to the text of the summaries are not made without consent from the lead authors of the chapter in question. Thus, while government officials at this level may outnumber scientists, the scientists still have a significant amount of "control" over the documents.

The WG plenary discussions represent the first step towards acquiring a political acceptance of the knowledge base developed in the scientific core and its substantive conclusions. Having undergone this thorough and detailed treatment, where alternative formulations and interpretations of the corresponding formulations in the bulk report have been discussed and negotiated, the substantive conclusions of the knowledge base are in a sense "tried out" and "digested" by policy-makers. Having survived this intense scientific and political scrutiny with their scientific credibility and authority intact, the substantive conclusions come out as more robust.

The accepted and approved assessment report and summaries are then submitted to the full panel plenary for acceptance. The full panel plenary cannot, however, amend a report that has been accepted or approved by the WG plenary. This institutional device is important for ensuring consistency between the summaries and the assessment report upon which the summaries are based.

At the WG plenary, lead authors' scientific authority is used as a vehicle for ensuring this consistency and also to prevent scientifically unsubstantiated formulations from entering the summaries. While lead authors usually participate at the WG plenary level, they seldom participate in the full panel plenary meetings. The inability of the full panel plenary to amend text that has been approved by the WG plenaries also prevents the reopening in the full panel plenary of controversial issues already settled in the WG plenaries.

Thus, while the assessment process is formally finalised with the acceptance of the assessments and summaries by the panel plenary, it is in practice finalised with the acceptance and approval of the reports by the WG plenary (according to the 1993 rules of procedure).

The panel plenary also approves the Synthesis Report drafted by the leadership of each of the three WGs in co-operation with a specially invited group of scientists, lead authors and experts. The 1995 Synthesis Report was developed and discussed at several conferences with broad participation. The procedure by which consensus on the Synthesis Report is developed in the panel plenary is, in form, similar to the negotiations taking place in WG plenary meetings. A notable exception is the near absence of scientists at this decision-making level. This place a special burden and challenge on the members of the drafting team who are present and the scientific leadership of the WGs and the panel.

2.4 Decision Rules and Recruitment Procedures

The IPCC has been criticised for forging a scientific consensus in an area characterised by scientific uncertainty and controversy. The scientific core of the IPCC, in which the assessments are developed, does not, however, operate under a consensus rule. On the contrary, a fair representation of the scientific debate is regarded as a main objective.

The development of an assessment which reflects the scientific debate with its inherent uncertainties and controversies and which, thus, is acceptable to all parties in the debate is considered an important objective of the IPCC process. In this regard, therefore, the IPCC assessments may be considered a consensual representation of state-of-the-art knowledge in the fields covered.

The IPCC plenaries, on the other hand, operate under a decision rule of consensus. The 1991 rules of procedure state that, "in taking decisions, drawing conclusions, and adopting reports, the IPCC Plenary and Working Groups shall use all best endeavours to reach consensus." Furthermore, in the 1991 rules of procedure it is stated that, "if consensus is judged by the relevant body not possible…for conclusions and adoption of reports, differing views shall be explained and, upon request, recorded." ("Principles governing IPCC work" from 1991, item 6).

Thus, in cases where consensus can not be achieved, dissenting views may be recorded in footnotes to the text. In WG I, however, this has never been necessary. Even in the most fierce discussions, WG I has largely managed to develop formulations acceptable to all parties[1]; government officials as well as scientists.

The lead authors have a major responsibility in the development of the assessments, as well as in the WG approval of the summaries. They are key players in the selection of contributors and expert reviewers (and also, on some occasions, in the selection of other lead authors). Above all, they bear the main responsibility for incorporating into the assessments all scientifically substantiated viewpoints and findings of the scientific community, as communicated to them by contributors and reviewers, in a representative and balanced manner.

While lead authors are selected from lists of nominations by governments, the actual choice lies with the scientific leadership of the WGs. Scientists not on the nomination list are never chosen as lead authors, but the IPCC leadership have on some occasions approached governments to have particular scientists nominated (personal communication with Bert Bolin). The procedure whereby lead authors are chosen has become increasingly formalised during the course of the process, but even with the formalisation of procedures in 1993, there are relatively few formal requirements guiding the choice. It is, however, emphasised that due consideration is given to scientists "known through their publication or work". The "technical ability" of the lead author and their "ability to work to deadlines" are also emphasised as important criteria. Finally, it is pointed out that teams of lead authors "should reflect a fair balance of different points of view".

The institutional set-up of the IPCC, and particularly the capacity of institutional arrangements to balance and combine scientific autonomy with policy involvement, seems to have contributed substantially to the extent to which policy-makers have acknowledged the scientific authority of the knowledge base and accepted its substantive conclusions as factually valid. Policy-makers' confidence in the research results seems to be drawn from at least two main sources: First, the scholarly competence, integrity and independence of the scientists involved in the process, and second, the adversarial scrutiny by actors and parties representing conflicting interests in the policy area. In an area as conflict-prone as climate change policies, the latter mechanism seems at least as crucial as the first.

[1] There are some footnotes of dissent in the Synthesis report.

3 On climate change

3.1 Remembrance of things past: On past climate change

With this background on the establishment and organisational set up of IPCC, we now turn to the issue at hand, namely climate change.

Since its creation 4.6 billion years ago, the Earth has gone through large changes. Continents have been born and reformed, the solar output has increased some 30 percent, and the atmospheric composition has changed dramatically. Given these changes, it is a near miracle that life has evolved and still remains on this planet.

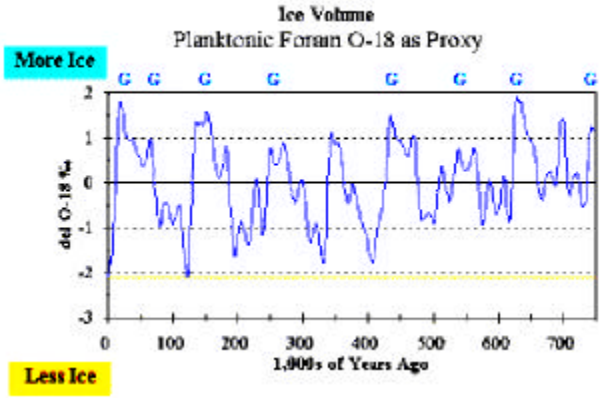

Figure 5: Ice ages over the last 750,000 years

The main causes of global climate change are usually enumerated as follows:

- Variations in solar radiation
- Variations in the Earth's orbit
- The shape and position of the continents
- Volcanic eruptions
- Variations in the reflections from the Earth's surface and atmosphere (albedo)
- Changes in the composition of the Earth's atmosphere:
  - gasses
  - aerosols
  - cloud cover

These driving forces operate on a number of time scales, from the very long geological time scale to a more 'human' short time scale.

Some highlights from the history of the Earth

Time (thousand years ago)	
4 600 000	The creation
3 300 000	First life
680 000	First animal
470 000	First fish
412 000	First plant
330 000	First tropical forest
215 000	First dinosaur
140 000	First bird
65 000	Dinosaurs die out
2 300	First homo
100	First homo sapiens
40	Eurasia invaded by homo sapiens
15	Cave paintings in France and Spain
10	The end of the last ice age
8	First civilization
4	First cities

Adapted from C. Boyle (ed.)(1991): The Human Dawn, Time-Life Books B.V., Amsterdam.

Concerning the long time scale we note that over the lifetime of the Earth one believes that it has experienced four so-called 'ice houses'; extended cold periods where ice ages has come and gone. Currently we are in such an 'ice house' which started

some 1.6 million years ago (the Pleistocene Epoch) and we have so far experiences some 40 ice ages during this period, see figure 5 for a record of ice ages over the last 750,000 years. The most recent ice age ended some 10,000 years ago.

To put these time scales into perspective one can note some other memorable moments in the Earth's development (see above).

Homo sapiens are thought to have first appeared about 400,000 years ago, certainly in Africa and perhaps in parts of Asia as well. Anatomically modern humans appeared in Africa and possibly in Asia perhaps 100,000 years ago and eventually arrived in Europe. Whether they supplanted or absorbed Neanderthal populations is not clear.

Among these European peoples, the best known is the Cro-Magnons. Their populations expanded rapidly throughout Europe, and their level of material culture became increasingly more complex and sophisticated. The emergence of fully modern humans in other parts of the world is less understood, though it seems to have occurred 30,000-15,000 years ago and involved various migrations and the intermingling of different populations[2].

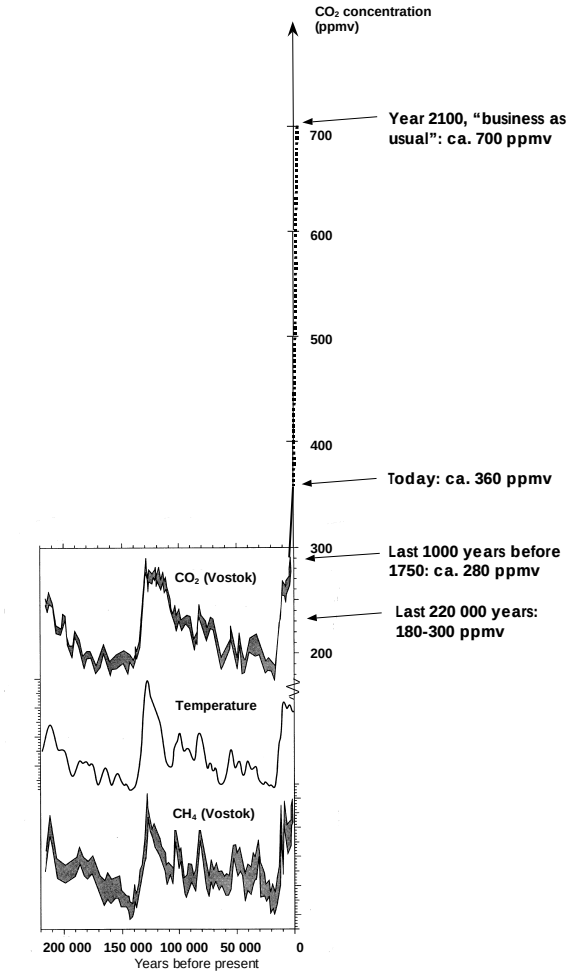

Figure 6: CO_2 and CH_4 concentration and temperature over the last 200,000 years together with current and expected CO_2 concentration levels in the atmosphere

After the end of the last ice age the climate not only became generally warmer, but also in an important way more stable. There is increasing evidence that not only during cold periods with extended glaciation, but also in the previous warmer inter-glacial periods, the climate was characterised by large variability on a short (decadal) time scale. Only after the last ice age seems the climate to some extent to have quieted down.

It is noteworthy that agriculture only emerged ca. 7,000 – 8,000 years ago, ie. a couple of thousand years after the end of the last ice age and only after a quieter climatic period started. This event, or the establishment of cities some thousands of years later, can perhaps be said to represent the start of the civilisation as we know it. Thus, our civilisation has only known our present calm and stable climate.

[2] See "human evolution" in *Britannica Online:* http://www.eb.com:180/cgi-bin/g?DocF=micro/281/28.html

In this context it is useful to take a look at a graph (figure 6) showing temperature and CO_2 levels in the atmosphere since the next but last ice age. The figure gives a vivid picture of the rate of change we are currently imposing on the atmospheric composition. Already, the CO_2 concentration is far above anything we have experienced over the last 200,000 years. The near vertical increase in CO_2 concentration also gives an indication of the unprecedented rate of change we now impose on the climate system.

The concentration of methane (CH_4) has increased even more; 145% since pre-industrial time. Taken together with the increasing acknowledgement of the potential instability of the climate system, also in warm inter-glacial stages, the picture provides an important piece of motivation for the work undertaken within the IPCC system.

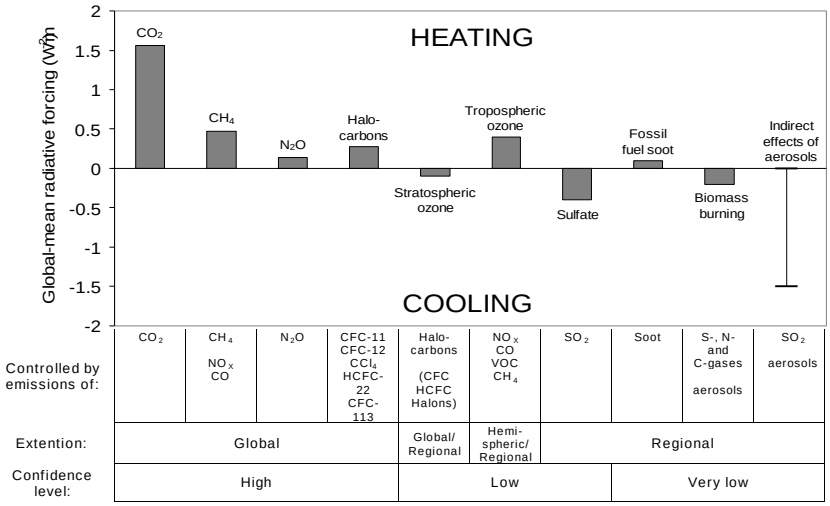

Figure 7 Radiative forcing from atmospheric constituencies

Source: Skodvin and Fuglestvedt (1997)

Finally, figure 7 shows the impact on climate change (through changes in radiative forcing) of some important atmospheric greenhouse gases emitted by human activities.

3.2 The present

Returning to the opening statement from the Second assessment report of IPCC that "The balance of evidence, … suggests a discernible human influence on global climate", it is a fact that the statement drew a lot of criticism. This was partly due to the difficulties encountered when interpreting the current signals on climate change[3]. Although the wording of IPCC is very cautious, it remains debatable whether we in fact today observe 'a discernible human influence'. What is not in doubt however, barring very large surprises, is that we in the future will see such influence on the global climate. Thus, the debate of the above statement is in a sense spurious and related only to a specific and rather short period of time.

[3] Special interest groups opposing the whole notion of human induced climate change also made much out of a procedural error during the editing of one of the chapters. This controversy was however inconsequential with respect to the factual content of the chapter.

3.3 Things to come: On future climate change

IPCC has compiled a set of more or less likely emission scenarios based on various assumptions regarding population growth, economic development and technological progress. The implications of these scenarios on some global climate indicators have then been worked out, see figure 8.

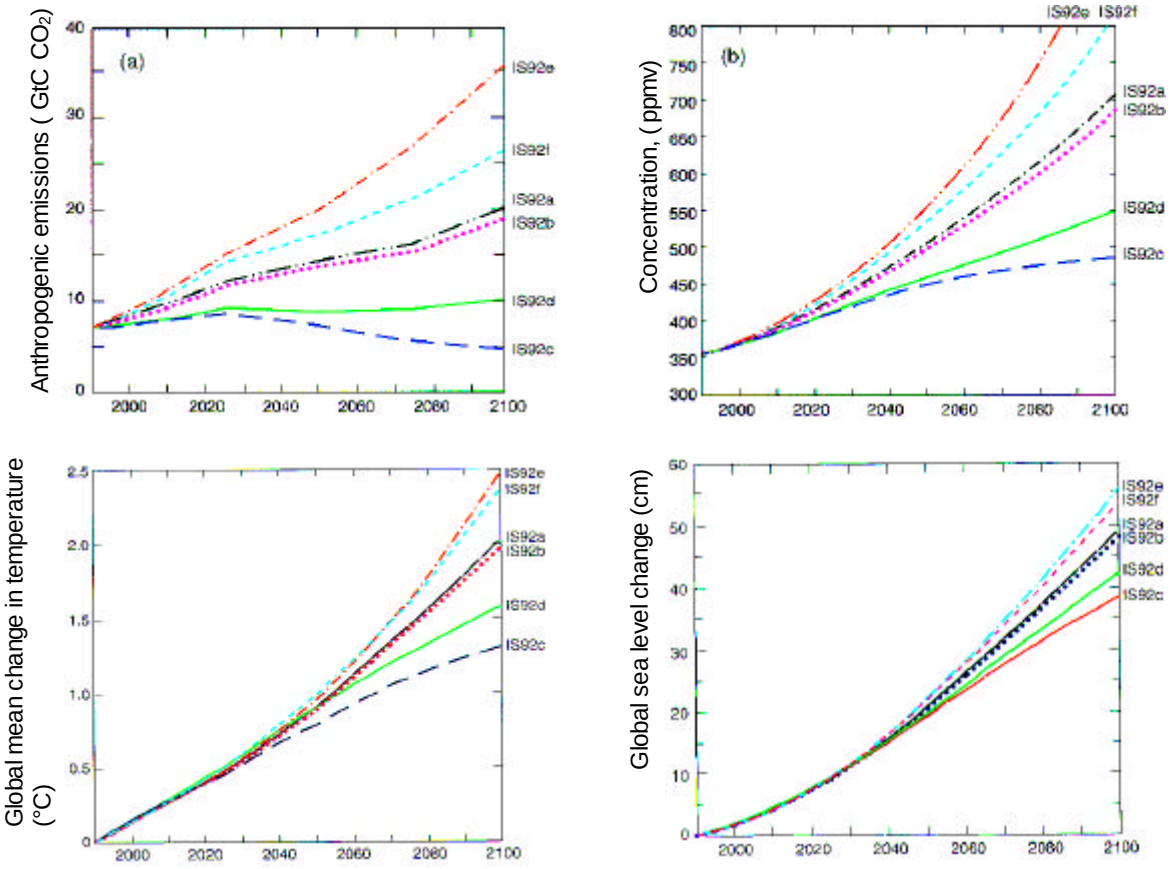

Figure 8: IPCC scenarios

Based on analyses like these, the IPCC warns that we during the next century may face an (additional) increase in mean global temperature of between 1 and 3.5 degrees Celsius and a sea level rise of between 15 and 95 cm. However, these global indicators do not tell us much about the regional and local effects of climate change. Some of the more significant concerns are:

- precipitation is thought to increase under generally warmer conditions, and the distribution of precipitation is probably going to be more extreme in that dry places will get drier while wet places will get wetter,
- during winter, the warming will be more pronounced over land than over oceans,
- warming will be strongest in the north at high latitudes,

- more days with extreme heat and fewer days with extreme cold are expected.

It is therefore still too early to say precisely *where* these changes will take place. The task of determining the likely regional distribution of a global climate change is a main challenge for IPCC.

3.4 Concluding remarks: On the nature of the climate problem

The problem of climate change is not mainly a problem of increased global average temperature and precipitation. The seriousness of the problem is more related to the potential variability and instability of the global climate and the local weather. We now know that the climate system in the past has shown great and rapid fluctuations due to natural causes. The stable climate regime observed after the last ice age is currently perturbed by the large outpouring of greenhouse gases due to human activities of many kinds.

The question then is whether the stability of the current climate regime is able to withstand this kind of disturbance. At present, we really do not know the answer to this. Furthermore, if the climate system becomes more unstable, it is very difficult to predict the local and even regional consequences with any precision. Thus, the problem of climate change is riddled with uncertainties, and the main challenge for human kind in this situation is to devise a rational response to this uncertainty. Certainly we should be willing to pay some form of insurance premium in order to reduce the risk of damaging climate change, but how high a premium? And how much of the premium should be in the form of greenhouse gas emission reductions and how much in the form of investments in better defence against a more unstable climate?

IPCC's work is important in allowing us to get the best possible scientific foundation for answering these questions. However, providing an academic answer is one thing, to develop a politically feasible strategy is quite another. The merging of the scientific consensus and the political realities is therefore necessary, and the processes in the plenary sessions of IPCC are important steps in the direction of providing practical answers to the challenge of climate change.

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Appendix

Composition of the IPCC bureau

The Chairman of the IPCC Bureau is elected as a person, not as a state (e.g., Dr. Robert Watson is elected, not the United States). All other members are elected as states; the states then name the individuals (and their successors in the case that they leave). The Vice-Chairs serve as Co-Chairs of the Working Group Subgroups. IPCC requests that the individuals named be experts in the relevant fields.

The composition of the IPCC Bureau:
Chairman: Robert T. Watson
Vice-Chair: Japan - Katsuo Seiki
Vice-Chair: Kenya - Richard Odingo
Vice-Chair: India - Rajendra Pachauri
Vice-Chair: Brazil - Gylvan Meira Filho
Vice-Chair: Russian Federation - Yuri A. Izrael
Co-Chair of Working Group I: China - Ding Yihui
Co-Chair of Working Group I: United Kingdom - Sir John Houghton
Vice-Chair of Working Group I: Tanzania - Buruhani Nyenzi
Vice-Chair of Working Group I: Kuwait - Hassan Nasrallah
Vice-Chair of Working Group I: Venezuela - Armando Ramirez
Vice-Chair of Working Group I: Canada - John Stone
Vice-Chair of Working Group I: Australia - John Zillman
Vice-Chair of Working Group I: Switzerland - Fortunat Joos
Co-Chair of Working Group II: Argentina - Osvaldo Canziani
Co-Chair of Working Group II: United States of America - James McCarthy
Vice-Chair of Working Group II: Senegal - Alioune Ndiaye
Vice-Chair of Working Group II: Maldives- Abdullahi Majeed
Vice-Chair of Working Group II: Tunisia - Skander Ben Abdallah
Vice-Chair of Working Group II: Czech Republic - Jan Pretel
Vice-Chair of Working Group II: New Zealand - Martin Manning
Vice-Chair of Working Group II: France - Michel Petit
Co-Chair of Working Group III: The Netherlands - Bert Metz
Co-Chair of Working Group III: Sierra Leone - Ogunlade Davidson
Vice-Chair of Working Group III: Germany - Eberhard Jochem
Vice-Chair of Working Group III: Sri Lanka - Mohan Munasinghe
Vice-Chair of Working Group III: Peru - Eduardo Calvo
Vice-Chair of Working Group III: Cuba - Ramon P. Madruga
Vice-Chair of Working Group III: Indonesia - R.T.M. Sutamihardja
Vice-Chair of Working Group III: Norway - Lorents Lorentsen

In addition, there are Regional Representatives as follows:
IPCC Region I (Africa): Nigeria - Dr. A.Y. Salahu
IPCC Region II (Asia): Kuwait - A.H. Nasrallah
IPCC Region III (South America): Colombia - Dr. K. Robertson
IPCC Region IV (North and Central America and the Caribbean): Cuba - Dr. F. Moros

IPCC Region V (Southwest Pacific and Small Islands): Australia - Dr. J. Zillman
IPCC Region VI (Europe): Spain - Dr. M. Bautista Perez

Note: The Regional Representatives are usually unanimously nominated by the government representatives from the respective regions.

The current Bureau was elected unanimously by the IPCC. (Source: http://www.ipcc.ch)

Selected reports from IPCC

Special reports

- The Regional Impacts of Climate Change: An Assessment of Vulnerability. 1998. Editors: R.T. Watson, M.C. Zinyowera, and R.H. Moss. A Special Report by IPCC Working Group II.
  Summary for Policymakers (SPM)

Technical papers

- Technical Paper I: Technologies, Policies, and Measures for Mitigating Climate Change. Intergovernmental Panel on Climate Change, Working Group II. November 1996.
- Technical Paper II: An Introduction to Simple Climate Models Used in the IPCC Second Assessment Report. Intergovernmental Panel on Climate Change, Working Group I. February 1997.
- Technical Paper III: Stabilization of Atmospheric Greenhouse Gases: Physical, Biological and Socio-Economic Implications. Intergovernmental Panel on Climate Change, Working Group I. February 1997.
- Technical Paper IV: Implications of Proposed CO2 Emissions Limitations. Intergovernmental Panel on Climate Change, Working Group I. October 1997.

Reports

- Climate Change 1995: The Science of Climate Change. Contribution of Working Group I to the Second Assessment Report of the Intergovernmental Panel on Climate Change.
- Climate Change 1995: Impacts, Adaptations and Mitigation of Climate Change: Scientific-Technical Analyses. Contribution of Working Group II to the Second Assessment Report of the Intergovernmental Panel on Climate Change.
- Climate Change 1995: Economic and Social Dimensions of Climate Change. Contribution of Working Group III to the Second Assessment Report of the Intergovernmental Panel on Climate Change.
- Climate Change 1994: Radiative Forcing of Climate Change (includes a Summary for Policymakers) and an Evaluation of the IPCC IS92 Emission Scenarios (includes a Summary for Policymakers and a Technical Summary).
- Preparing to Meet the Coastal Challenges of the 21st Century, Conference Report of the World Coast Conference, 1993.
- Climate Change 1992: The Supplementary Report to the IPCC Scientific Assessment. Report of the IPCC Scientific Assessment Working Group (Working Group I).
- Climate Change 1992: The Supplementary Report to the IPCC Impacts Assessment. Report of the IPCC Impacts Assessment Working Group (Working Group II).

- Global Climate Change and the Rising Challenge of the Sea: Report of the Coastal Zone Management Subgroup of the IPCC Response Strategies Working Group (Working Group III), 1992.
- Proceedings of a Workshop on Assessing Technologies and Management Systems for Agriculture and Forestry in Relation to Global Climate Change, Canberra, 1992.
- Report of the IPCC Country Studies Workshop, Berkeley, CA, 1992.
- Climate Change: The IPCC 1990 and 1992 Assessments - IPCC First Assessment Report Overview and Policymaker Summaries, and 1992 IPCC Supplement.
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- Climate Change: The IPCC Impacts Assessment, 1990. Report of the IPCC Impacts Assessment Working Group (Working Group II).
- Climate Change: The IPCC Response Strategies, 1990. Report of the IPCC Response Strategies Working Group (Working Group III).
- Emission Scenarios: Prepared for IPCC Response Strategies Working Group (Working Group III), 1990.
- Observed Climate Variations and Change: Contribution in Support of Section 7 of the 1990 IPCC Scientific Assessment, 1990.
- Report of the Energy and Industry Subgroup of the IPCC Response Strategies Working Group (Working Group III), 1990 (prepared for IPCC).
- Strategies for Adapation to Sea Level Rise: Report of the Coastal Zone Management Subgroup of the IPCC Response Strategies Working Group (Working Group III), 1990.
- Adaptive Options and Policy Implications of Sea Level Rise and Other Coastal Impacts of Global Climate Change: Report of the Coastal Zone Management Subgroup of the IPCC Response Strategies Working Group (Working Group III), 1989.
- Climate Change Impacts Studies Database (Prepared for IPCC).

Methodologies

- IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptations, 1994 (includes a Summary for Policymakers and an Executive Summary).
- Carbon Balance of World Forested Ecosystems: Toward a Global Assessment.
- IPCC Guidelines for National Greenhouse Gas Inventories (3 volumes), 1994.
- Preliminary Guidelines for Assessing Impacts of Climate Change, IPCC Working Group II, 1992.
- Assessment of the Vulnerability of Coastal Areas to Sea Level Rise - A Common Methodology. Report of the Coastal Zone Management Subgroup of IPCC Working Group III, 1991.
  [See also: Annex C in *Global Climate Change and the Rising Challenge of the Sea: Report of the Coastal Zone Management Subgroup of the IPCC Response Strategies Working Group (Working Group III), 1992.*]
- Compilation of References to the Spectroscopic Database for Greenhouse Gases: Prepared for IPCC Working Group I by Nicole Husson, France, 1991.

This is CICERO

CICERO was established by the Norwegian government in April 1990 as a non-profit organization associated with the University of Oslo.

The research concentrates on:

- International negotiations on climate agreements. The themes of the negotiations are distribution of costs and benefits, information and institutions.
- Global climate and regional environment effects in developing and industrialized countries. Integrated assessments include sustainable energy use and production, and optimal environmental and resource management.
- Indirect effects of emissions and feedback mechanisms in the climate system as a result of chemical processes in the atmosphere.

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